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RESEARCH ARTICLE

**LENGTH-WEIGHT RELATIONSHIPS OF 15 GROUND FISH SPECIES CAUGHT IN
TUNISIAN DEEP WATER (SW MEDITERRANEAN SEA)**

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ABSTRACT

The length-weight relationship of 15 ground fish species from Tunisian deep water (SW Mediterranean Sea) belonging to 9 families (Lophidae, Citharidae, Scorpaenidae, Serranidae, Triglidae, Trachinidae, Gadidae, Uranoscopidae, Zeidae) were estimated. A total of 3765 specimens were used for this purpose. Growth coefficient, (b) of the LWR ranged from 2.88 (*Serranus cabrilla*) to 3.28 (*Trachinus draco*) and the intercept of the regression model (a) between 0.0044 and 0.0702.

Key words:

L-W relationships, ground fish,
Tunisian deep water, bottom
trawl.

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INTRODUCTION

Over the last decade, fisheries activities have been faced with a serious crisis because of the dramatic decrease of fish stocks in Tunisian waters and especially in the coastal area (Ghorbel, 1996; Jarboui *et al.*, 1998, Cherif, 2014). Thus, to preserve their activity, Tunisian fishermen have decided to trawl deeper and deeper.

Despite previous learning from foreign deep sea fisheries highlighting that this resource is sensitive to overexploitation. Tunisian fisheries administrator has not issued any regulation to control or limit the exploitation of deep sea fish species. In response to this need, the length weight relationships of fish are crucial in fisheries investigations and stock assessment (Bagenal and Tesch, 1978, Bolger and Connolly, 1989). The values are important for estimation of number of fish landed at a particular time and comparison of fish species populations caught from various places at similar or different times (Thomas *et al.*, 2003). The present study presents estimates of the length weight relationships for 15 ground fish belonging to 9 families with economic value but poorly studied in Tunisia

MATERIAL AND METHODS

Samples of fish were taken at 3 localities (Z1, Z2 and Z3) in the northern Tunisian coast (Figure 1). A total of 3765

specimens were collected during the DEMNORD research cruises in spring and summer of year 2011. Individuals were captured between 200 and 600 m depth with a shrimp trawl net (20 mm mesh size). A total of 23 hauls was conducted during the study period. Mean towing speed was about 3 knots. Sampling duration ranged between 45 and 60 minutes per haul. The bottom structure included seagrass beds, bare sandy bottoms and muddy substrates or rubble (Azouz, 1973 & 1974).

Specimens were measured with digital slide callipers up to the nearest 0.1 cm and weighed with an electric balance up to the nearest 0.1 g. The length-weight relationship was estimated for each species by adjustment of an exponential curve to the data ($W = aL^b$). This can be expressed in linear form after logarithmic transformation by $\log W = \log a + b \log TL$, where W is weight and TL is total length, (a) is intercept, and (b) is slope. The degree of association between the variables was computed by the determination coefficient, r^2 . Based on their scores of growth exponents, the fishes were grouped in the isometric range ($b = 3.0$) or allometric ranges (positive allometry: $b > 3.0$ or negative allometry: $b < 3$) indicating poor, over and symmetric growths of length and weight respectively (Santos *et al.*, 2002). In order to confirm whether b-values obtained in the linear regressions were significantly different from the isometric value (3), a t-test ($H_0: b=3$) with a confidence level of $\pm 95\%$ ($\alpha = 0.05$) was applied, expressed by the following equation (Sokal and Rohlf, 1987).

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$$t_s = (b-3)/s_b$$

Where t_s is the t-test value, b the slope and s_b the standard error of the slope (b).

In this study the sexes were not differentiated here, although we are aware that males and females may have different length-weight relationships.

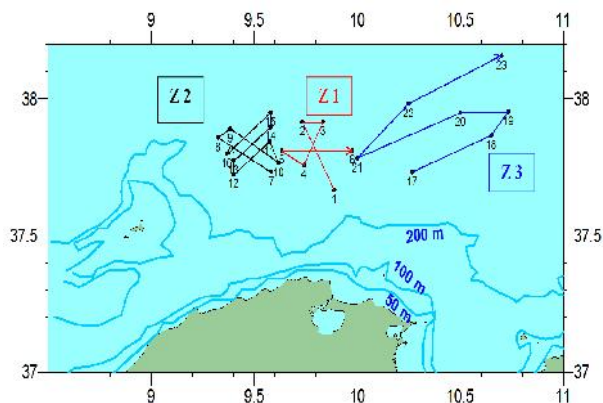


Figure 1 Sampling area in the Northern Tunisia coasts (Mediterranean Sea). Where Z1: Zone1, Z2: Zone 2 and Z3: Zone 3.

The r^2 values ranged from 0.88 for *Lophius piscatorius* to 0.99 for *Zeus faber* and *Serranus scriba*, and all regressions were highly significant ($p < 0.005$). Values of b ranged from 2.88 for *Serranus cabrilla* to 3.28 for *Trachinus draco*. The growth type varied between isometric and allometric, according to Student's t-test (Table 1).

The relationships between length and weight of ground fish species in the present study have more or less similar growth patterns with those published from other areas by several authors (e.g. Petrakis and Stergiou, 1995, Stergiou and Moutopoulos, 2001, Özaydin and Taskavak, 2006, Olim and Borges, 2006, Romdhani et al. 2013). The differences can be caused by the different abiotic or biotic factors such as availability of food items and competition for them or the fishing activities in the areas (Bagenal and Tesch 1978). Beside it may be depended on the length distribution of the aged samples (Cherif et al, 2007, Ihan et al, 2010, Hajjej et al, 2011). Our results can enable fish biologists to disclose information that is useful to the fisheries management and assist in estimating the biomass of captured fish species. Therefore, we believe that our results should be used with caution outside of the indicated length ranges.

Table 1 Length-weight relationships for 15 fish species caught from the Tunisian deep water

| Family/Species | N | TL range (cm) | W range (gr) | a | b | r ² | S.E _b | t-test | Relationship | |
|----------------|----------------------------|---------------|--------------|---------------|--------|----------------|------------------|--------|--------------|---------------|
| Serranidae | <i>Serranus cabrilla</i> | 432 | 10.2-21.7 | 34.62-240.51 | 0.0371 | 2.88 | 0.96 | 0.087 | 1.38 | Allometry (-) |
| | <i>Serranus scriba</i> | 511 | 8.3-22.1 | 38.90-457.42 | 0.0702 | 2.91 | 0.99 | 0.017 | 5.29 | Allometry (+) |
| | <i>Serranus hepatus</i> | 344 | 8.2-16.7 | 14.72-120.57 | 0.0167 | 3.14 | 0.91 | 0.123 | 1.14 | Isometric |
| Scorpaenidae | <i>Scorpaena porcus</i> | 268 | 10.1-24.2 | 32.39-311.97 | 0.0221 | 3.01 | 0.97 | 0.081 | 0.12 | Isometric |
| | <i>Scorpaena scrofa</i> | 271 | 9.8-26.3 | 27.25-382.71 | 0.0210 | 2.99 | 0.96 | 0.028 | 0.36 | Isometric |
| Triglidae | <i>Trigla lucerna</i> | 256 | 11.7-27.9 | 28.2-311.62 | 0.0077 | 3.17 | 0.98 | 0.192 | 0.89 | Isometric |
| | <i>Trigla lyra</i> | 147 | 9.7-22.3 | 8.11-105.27 | 0.0061 | 3.12 | 0.89 | 0.043 | 2.79 | Allometry (+) |
| Gadidae | <i>Phycis phycis</i> | 189 | 11.1-27.6 | 27.39-450.67 | 0.0074 | 3.10 | 0.93 | 0.121 | 0.83 | Isometric |
| | <i>Phycis blennoides</i> | 320 | 15.2-42.3 | 37.72-810.6 | 0.0051 | 3.19 | 0.96 | 0.065 | 2.92 | Allometry (+) |
| Lophidae | <i>Lophius budegassa</i> | 103 | 17.2-57.6 | 131.11-4497.2 | 0.023 | 2.98 | 0.92 | 0.013 | 1.54 | Isometric |
| | <i>Lophius piscatorius</i> | 121 | 23.7-67.4 | 321.8-6847.6 | 0.034 | 2.91 | 0.88 | 0.114 | 0.79 | Isometric |
| Zeidae | <i>Zeus faber</i> | 163 | 7.2 - 26.4 | 9.61-401.53 | 0.0287 | 2.91 | 0.99 | 0.054 | 1.67 | Isometric |
| Trachinidae | <i>Trachinus draco</i> | 207 | 10.2-21.4 | 8.54-102.67 | 0.0094 | 3.28 | 0.98 | 0.090 | 3.11 | Allometry (+) |
| | <i>Citharidae</i> | 235 | 10.2- 20.7 | 5.69- 69.42 | 0.0044 | 3.11 | 0.94 | 0.101 | 1.09 | Isometric |
| Uranoscopidae | <i>Uranoscopus Scaber</i> | 198 | 8.2-33.1 | 6.62-450.71 | 0.0073 | 3.17 | 0.90 | 0.033 | 5.15 | Allometry (+) |

N: sample size; a and b: length-weight parameters; r²: coefficient of determination; S.E_b: standard error of b.

RESULTS AND DISCUSSION

A total of 3765 species of fishes belonging to 9 families were sampled.

The parameters of the length-weight relationships for the selected species are given in Table 1, together with the regression coefficient (r), the number of specimens measured (n), the size of the smallest (min) and largest (max) specimen measured.

The sample size ranged from 103 individuals for *Lophius budegassa* to 511 for *Serranus scriba*.

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